(b) Write down the products of the following two reactions :

(i) $CH_3Cl + KCN \longrightarrow ?$

(ii) $CH_3Cl + AgCN \longrightarrow ?$

Explain the mechanism of the two reactions. 3

(c) The solubility product (*Ksp*) of chalk is 9.3×10^{-8}. Calculate its solubility in g/lit. 2

(d) Write down the product

$$H_3C-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3 \xrightarrow{HF(l)/SbF_5} ?$$ 1

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Total Pages : 6

2024

2nd Semester Examination

CHEMISTRY (Honours)

Paper : C 3-T

[Inorganic Chemistry - I]

[CBCS]

Full Marks : 40 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group - A

Answer any ***five*** questions : 2×5=10

1. Arrange BF_3, BCl_3, BBr_3 and BI_3 in order of their Lewis acidity with proper justification.

2. The interionic distance in chlorine molecule is 1.98Å. Calculate the Allred-Rochow electronegativity using Slater's rule.

3. Second electron affinity is an exothermic process. Explain.

4. Write down the product and give reason.

$$(CH_3)_2 N - PF_2 + BH_3 + BF_3 \longrightarrow ?$$

5. Define comproportionation reaction. Give one example.

6. Calculate the longest wavelength of light that will be needed to remove an electron from the 3rd orbit of He^+ ion.

7. Explain why the ground state electronic configuration of Cr is $3d^5 4s^1$ and not $3d^4 4s^2$.

8. What is the significance of the negative sign in the expression of the energy of an electron in a hydrogen like atom or ion?

Group - B

Answer any ***four*** questions : 5×4=20

9. (a) Show that the Bohr's postulate of quantised angular momentum for an electron moving in a circular orbit can be derived by the application of de Broglie's hypothesis. 3

   (b) Draw the Frost diagram from the given Latimer diagram :

$$O_2 \xrightarrow{0.70V} H_2O_2 \xrightarrow{1.76V} H_2O$$ 2

10. (a) When Fe(II) is treated with $K_2Cr_2O_7$ in acid medium in presence of diphenyl amine, little H_3PO_4 is added prior to titration. Explain the role of H_3PO_4. 2

(b) Show that the frequency of revolution of an electron in a Bohr orbit with quantum number 'n' is given by the expression —

$$\gamma_{orb} = \frac{4\pi^2 mz^2 e^4}{n^3 h^3}$$

[γ_{orb} = orbital revolution frequency] 3

11. (a) Calculate the minimum uncertainty in the location of

   (i) a 1g mass moving with a speed of $1.5 ms^{-1}$ and

   (ii) an electron moving with a speed of $2.2\times10^6 ms^{-1}$.

   In each case the uncertainty in the momentum measurement is 0.1 percent. 3

   (b) Standard electrode potentials of Fe^{3+}/Fe^{2+} and $[Fe(CN)_6]^{3-}/[Fe(CN)_6]^{4-}$ couples are 0.77V and 0.36V, respectively. Find the stability of $[Fe(CN)_6]^{3-}$ complex relative to $[Fe(CN)_6]^{4-}$ complex. 2

P.T.O.

12. (a) Calculate Pauling electronegativity of *Br* from the following data :

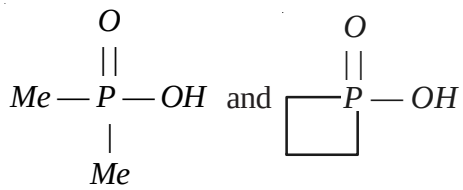
Bond energy of H_2 = 104.2 kcal/mole

" " " Br_2 = 46.1 " "

" " " *HBr* = 87.4 " "

Pauling electronegativity of hydrogen = 2.1 3

(b) Which one of the following is more acidic and why?



2

13. (a) State Slater's rule and using these calculate the effective nuclear charge for the 4*S* electron in *Zn* atom. 3

(b) Calculate the wavelength of H_β line. Given the wavelength of H_α line is 6563×10^{-10}m. 2

14. (a) Define solubility product. Give an expression for the solubility product of calcium phosphate. 2+1

(b) What would be the size of a Ne^{9+} according to the Bohr's model? 2

Group - C

Answer any ***one*** question : 10×1=10

15. (a) Write Pauli Exclusion Principle. Hence show that the L-shell can hold a maximum of 8-electrons. 3

(b) A car of mass 2.90×10^3kg is moving with a velocity which can be measured with an accuracy ± 0.004 km/hr and its position can be determined with an accuracy of ± 0.02 km.

Show that the uncertainty principle is not applicable here. 3

(c) Balance the equation by ion-electron method.

(i) $P + NaOH + H_2O \rightarrow PH_3 + NaH_2PO_2$

(ii) $KMnO_4 + H_2SO_4 + FeSO_4 \rightarrow K_2SO_4 + MnSO_4 + Fe_2\left(SO_4\right)_3 + H_2O$

2+2

16. (a) The Photoelectric work function of a metal is 2.0V.

(i) Calculate the threshold wavelength.

(ii) What will be the velocity of the most energetic electrons when the metal is irradiated with light of wavelength 3999Å. 1+3

P.T.O.